



Annual External Evaluation Report

PathTech: Successful Academic and Employment Pathways in Advanced Technologies

NSF Award #1104214

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Submitted by:

Thomas J. Horwood & Kristen Peterson
ICF International
9300 Lee Highway
Fairfax, VA 22031

Submitted to:

University of South Florida
3650 Spectrum Blvd
Tampa, FL 33612

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1. Overview of PathTech and the External Evaluation

1.1 About the PathTech Project

The Successful Academic and Employment Pathways in Advanced Technologies (PathTech) project continued to be funded in its third year through a grant from the National Science Foundation (NSF) Directorate for Education and Human Resources (DEHR) under the Advanced Technological Education (ATE) program (NSF Award #1104214). The NSF ATE program promotes the improvement of education, particularly at two-year colleges, for science and engineering technicians entering into high-technology fields. The ATE program supports different types of activities, including the development of curriculum, educator professional development, career pathways, articulation between two-year and four-year programs for potential educators, and research to add to the understanding of various aspects of educating technicians for careers in high-technology fields.

PathTech is a research study designed to examine the progression of students from high school into advanced technology programs, specifically engineering technology (ET), at community colleges and into the workforce. This field-based targeted research study involves collaboration between two-year community and technical colleges, industry partners, and local high schools. These collaborations have led the PathTech research team to explore unanticipated avenues that can strengthen partnerships and pathways and ultimately inform practices in ET programs through advancing the knowledge base around ET students.¹ This study is being conducted over four years between September 1, 2011 and August 31, 2015. Grant funds for this project period total \$1,196,790.

The NSF ATE grant for the PathTech project was awarded to the University of South Florida (USF), which established a collaboration of higher education institutions in Florida, including researchers from the Departments of Sociology and Education at USF, the Florida Advanced Technological Center (FLATE) at Hillsborough Community College (HCC), Polk State College (PSC), St. Petersburg College (SPC), and State College of Florida (SCF). Dr. Will Tyson (USF – Sociology) is the principal investigator, and Dr. Marie Boyette (FLATE at HCC) has been serving as co-principal investigator since the project inception. Dr. Kathryn Borman (USF) served as another co-principal investigator until her retirement at the end of the spring 2013 semester. In Year 1 of the grant, the project leaders expanded the research team to include university students and other research staff to contribute to the PathTech project. In January 2013, Dr. Lakshmi Jayaram (USF – Sociology) was added to the project as the lead qualitative investigator and Dr. Edward Fletcher (USF – Education) was added as a quantitative investigator. Dr. Chrystal Smith (USF – Sociology) is the PathTech program manager.

1.1.1 PathTech Research Design and Methodology

The PathTech project continues to work toward contributing to a growing body of knowledge on advanced technician education and to the overall mission of the NSF ATE program by:

- increasing understanding of recruitment and pathways into ET programs,
- providing information to improve the education of engineering technicians,
- discovering promising practices and recommending interventions at high schools to increase the visibility of ET programs at local community colleges, and

¹ NSF ATE grant request for application

- providing information about practices that produce more qualified science and engineering technicians to meet workforce demands.

RESEARCH QUESTIONS

The purpose of the PathTech research study is to answer two main research questions, each with three subquestions:

1. Who enrolls in ET community college programs out of high school?
 - a. How are student demographic and academic characteristics related to ET enrollment?
 - b. How do students learn about ET programs (i.e., outreach)?
 - c. How can the pathway from high school into ET programs be improved?
2. How do ET students benefit from enrolling (in degree programs) and earning degrees through these programs?
 - a. What are the most critical steps in ET degree attainment from enrollment through gatekeeper courses and to the degree?
 - b. How do these students become ET graduates?
 - c. How do ET students differ from comparable students in their degree and employment outcomes?

These research questions continue to be the main focal points of all aspects of the research study, including the instruments that are used to collect qualitative data from various stakeholders and the quantitative analysis plans.

METHODOLOGY

PathTech is a mixed-method study that is employing both descriptive statistics and empirical analysis of verifiable quantitative data from state databases along with ethnographic (qualitative) methods. Quantitative analyses examine statewide trends in career academy participation and engineering technology enrollment. Quantitative data from the Florida Department of Education (FLDOE) PK-20 Education Data Warehouse (EDW), Florida Education & Training Placement Information Program (FETPIP), and other sources,² as well as data from site visits, are used to construct several indicators of high school preparation that predict enrollment into ET programs. The research team is analyzing retrospective data from students during Grades 9-12 to measure high school and post-secondary coursetaking, achievement, and degree attainment. Four cohorts of students who graduated from high school and entered into the full-time workforce or post-secondary schooling in 2007-08, 2008-09, 2009-10, 2010-11 will be tracked.

Qualitative analyses focus on four engineering technology programs housed at community college campuses in the Tampa Bay region of Florida, as well as feeder high schools and local industry partners. Site visits and in-depth interviews are being conducted in this region, which contains a concentration of high school STEM career academies, STEM industries, and community colleges that offer advanced technology associates degrees. In addition, the PathTech team conducted a case study of women in ET programs at local community colleges in Year 3, collecting data through background surveys and in-depth interviews.

² The PathTech team has obtained quantitative data from other sources in order to fill gaps caused when some datasets have not been available as planned.

1.1.2 PathTech Project Timeline

In Year 3 of the PathTech project, the research team planned to conduct the following activities, which included five tasks that carried over into Year 3 from Years 1 and 2, as well as three ongoing tasks initially planned for Year 3:

Year 1 (tasks carried over into Years 2 and 3)

1. Carry out data preparation, descriptive analysis of current FLDOE data
2. Conduct propensity score analysis to create samples of students with equal propensity of being in a STEM-themed career academy and propensity score analysis at the school level to create pairs of schools with equal propensity of having a STEM-themed career academy in using Cohorts 1 and 2

Year 2 (tasks carried over into Year 3)

1. Conduct multivariate, multi-level analysis of ET enrollment based on student-level demographic and academic factors and school-level characteristics among students in STEM career academy propensity groups
2. Carry out data preparation, descriptive analysis of Florida Education & Training Placement Information Program (FETPIP) employment data and post-secondary academic outcomes
3. Conduct multivariate, multi-level analysis of the impact of enrollment in engineering technologies on early post-secondary outcomes among Cohorts 1 and 2 students who enrolled in ET programs compared to students who did not

Year 3

1. Carry out site visits to [and corresponding analysis for]:
 - a. Four community colleges with Associate of Science (AS) degrees in ET
 - b. Four high schools with engineering career academies
 - c. Local industry partners that hire AS degreed engineering technicians
2. Conduct multivariate, multi-level analysis of the impact of AS engineering technology degree attainment on short- and long-range post-secondary employment and academic outcomes among students who enroll in ET programs and comparable students who did not in all cohorts.
3. Write 1-2 papers for peer-review journal and/or conference presentations (e.g., AERA)

1.2 About the External Evaluation

The external evaluation of PathTech is being conducted by ICF International, led by Thomas Horwood as lead evaluator, Kristen Peterson as the lead analyst, and supported by Dr. Teresa Duncan and Dr. Katerina Passa. The external evaluation is intended to complement and support the efforts of the PathTech research team. The approach to external evaluation involves: (1) monitoring the progress of the various aspects of the project (e.g., outreach, data collection, quantitative analysis, qualitative analysis); (2) providing objective reviews of project instruments, protocols, analysis plans, and reports; and (3) serving as an external resource for technical advice.

This report serves as the third in a series of four annual evaluation reports and covers the third year of the implementation of the PathTech project. It serves as an update on the progress of the research project in meeting its goals, and includes cumulative updates for the first three

years of the project. Data were collected for this report through conversations with the PathTech project team during monthly calls, an external evaluation database used to track monthly progress of project activities, two evaluation site visits to USF and the Florida Forum on Engineering Technology (ET Forum), and a review of project documents (e.g., grant application, research instruments, research protocols, reports).

2. External Evaluation Findings – Year 3

This annual external evaluation report for Year 3 describes an assessment of the PathTech project team’s progress according to the workplan during the third year of the grant. The Year 3 project period was September 1, 2013 to August 31, 2014. Exhibit 1 shows the activities conducted in Year 3 for the five tasks from Year 1 and Year 2 that carried over into Year 3, as well as an update on the status of these tasks at the end of Year 3. All of the carried-over tasks involve quantitative data analysis and are reflective of delays in obtaining FLDOE data and missing variables in that data that were discussed in the annual evaluation reports in Years 1 and 2.

**Exhibit 1: Status of Year 1 and 2 PathTech Tasks in Year 3
(September 1, 2013 to August 31, 2014)**

Carried Over Task	Activities Completed	Status at End of Year 3
Year 1: Carry out data preparation, descriptive analysis of current FLDOE data	Year 1 – Submitted data requests were to FLDOE Year 2 – Obtained, examined, and cleaned datasets (although race variable is missing, making it of limited use) Year 3 – Explored access to National Academy Foundation (NAF) data through contact with NAF (see Exhibit 2, Year 3 Task 2)	Delayed (with Adjustment)
Year 1: Conduct propensity score analysis to create samples of students with equal propensity of being in a STEM-themed career academy and propensity score analysis at the school level to create pairs of schools with equal propensity of having a STEM-themed career academy in using Cohorts 1 and 2	Year 1 – Created analysis plans based on known variables expected to be collected Year 2 – Delayed analysis to Year 3 Year 3 – (see Exhibit 2, Year 3 Task 2)	Delayed
Year 2: Conduct multivariate, multi-level analysis of ET enrollment based on student-level demographic and academic factors and school-level characteristics among students in STEM career academy propensity groups	Year 2 – Conducted initial analysis of ET enrollment with FLDOE data without race variable Year 3 – (see Exhibit 2, Year 3 Task 2)	Delayed
Year 2: Carry out data preparation, descriptive analysis of Florida Education & Training Placement Information Program (FETPIP) employment data and post-secondary academic outcomes	Year 2 – Obtained data and prepared it for descriptive analysis (however, it is of limited use since FLDOE will not release employment data in conjunction with demographic data) Year 3 – (see Exhibit 2, Year 3 Task 2)	Delayed
Year 2: Conduct multivariate, multi-level analysis of the impact of enrollment in engineering technologies on early post-secondary outcomes among Cohorts 1 and 2 students who enrolled in ET programs and comparable students who did not	Year 2 – Developed analysis plans Year 2 – Conducted initial analysis of ET enrollment using FLDOE data Year 3 – (see Exhibit 2, Year 3 Task 2)	Delayed

In Years 1 and 2, the PathTech team submitted multiple data requests to FLDOE to request statewide education data to analyze trends in students' academic and career pathways. In Year 2, the team received FLDOE data; however, FLDOE declined to release data on race in conjunction with employment data, significantly limiting any potential analysis using this data. During Year 2, the PathTech team began exploring other relevant datasets that they could use to conduct a similar analysis, including data from the National Academy Foundation (NAF) and the National Longitudinal Survey of Youth, 1997 Cohort (NLSY97). In Year 3, the team continued pursuing these alternate data sources and began preliminary analysis with the NLSY97 data, and has plans to conduct further analysis with this alternate data in Year 4 (see Exhibit 2).

In addition to the tasks that carried over from Years 1 and 2, Exhibit 2 shows the activities completed, status, and notes about each of the three main tasks planned for Year 3 of the grant project period. Of the three major Year 3 tasks, one is for qualitative data collection, one is for quantitative data collection and analysis, and one involves dissemination.

Exhibit 2: Status of Year 3 PathTech Tasks in Year 3 (September 1, 2013-August 31, 2014)

Year 3 Task	Activities Completed – Year 3	Status at End of Year 3	Notes
1a. Qualitative: Carry out site visits to 4 community colleges with AS degrees in ET	<ul style="list-style-type: none"> ▪ Conducted site visits to 4 community and technical colleges ▪ Conducted interviews with 57 community college students and 4 community college administrators ▪ Developed additional protocols for a case study of women in STEM programs and interviewed six women to collect additional data for the case study ▪ Transcribed, cleaned, and de-identified all interviews ▪ Coded the information sheet/questionnaire data and continuing to code the interview data 	In Progress	<ul style="list-style-type: none"> ▪ Coding and analysis will continue into Year 4, although the team has coded a large amount of the qualitative data that they collected to date
1b. Qualitative: Carry out site visits to 4 high schools with engineering career academies	<ul style="list-style-type: none"> ▪ Developed consent forms and protocols in Year 2 ▪ Completed recruitment of three high schools ▪ Completed interviews with 55 high school students, 3 high school teachers, and 3 high school district administrators across three high schools ▪ Transcribed all interviews ▪ Developed a coding scheme and began coding data from high school interviews 	In Progress	<ul style="list-style-type: none"> ▪ The team will not continue with a fourth high school due to reaching saturation ▪ Full analysis of high school interviews will be finished in Year 4

Year 3 Task	Activities Completed – Year 3	Status at End of Year 3	Notes
1c. Qualitative: Carry out site visits to local industry partners that hire AS degreed engineering technicians	<ul style="list-style-type: none"> ▪ Conducted interviews with 10 industry partners in Year 2 and 27 industry employers in Year 3 ▪ Transcribed all interviews ▪ Completed coding and analysis for industry interviews; the team is taking a case study approach to analyzing data from industry interviews 	In Progress	<ul style="list-style-type: none"> ▪ Analysis and reporting of industry data will continue into Year 4
2. Conduct multivariate, multi-level analysis of the impact of AS engineering technology degree attainment on short- and long-range post-secondary employment and academic outcomes among students who enroll in ET programs and comparable students who did not in all cohorts.	<ul style="list-style-type: none"> ▪ Received FLDOE data in Year 2 but planned multivariate analyses were limited due to the lack of the race variable ▪ Requested and received NLSY97 data ▪ Began cleaning NLSY97 data 	In Progress	<ul style="list-style-type: none"> ▪ Plan to examine factors that lead individuals into technology careers and factors that relate to them staying in those careers
3. Write 1-2 papers for peer-review journal and/or conference presentations (e.g., AERA)	<ul style="list-style-type: none"> ▪ Presented at Southern Sociological Society meetings ▪ Presented at American Sociological Association ▪ Presented 3 papers at the Society for Applied Anthropology meeting ▪ Wrote and submitted paper to <i>Education Evaluation and Policy Analysis</i> ▪ Submitted an extended abstract to Russell Sage for an edited volume on higher education 	Completed	<ul style="list-style-type: none"> ▪ Also presented at the Florida Forum on Engineering Technology (ET Forum) and the USF Oktoberfest Research Symposium ▪ Continuing to write at least one additional paper based on qualitative findings

Each of the analytic tasks for Year 3 is in progress and will be completed during the final year of the grant, as planned. The team concluded their fieldwork in Year 3, interviewing 149 individuals in Year 3, including 57 community college students, 4 community college administrators, 55 high school students, 3 high school district administrators, 3 high school teachers, and 27 industry employers. After interviewing students at three regional high schools, the PathTech team determined that they had reached saturation in their sample and ended the interview process with three participating high schools rather than the four that were initially planned. Furthermore, the final partnering high school has established pathways into a local community college, and data from this school would likely have been outliers to the overall study. Coding and analysis are underway for each of these three qualitative subtasks and the PathTech team has presented their methods and preliminary trends to local, regional, and national audiences. The team met their goal for the number of paper submissions to peer-reviewed journals. In addition, the PathTech team has continued their strong collaborations with local, regional, and national partners through the ET Forum and conferences with professional organizations including the Southern Sociological Society, the American Sociological Association, and the Society for Applied Anthropology. In Year 3, the team presented multiple papers at the meetings of each of these organizations as well as at two local meetings, meeting their dissemination

goals for the year. In addition to using these platforms to disseminate findings, the PathTech team has cultivated partnerships with both the ET and educational research communities. These have led to access to industry partners for participation in the study and data sharing possibilities with NAF, which have strengthened the overall PathTech study. When full FLDOE data could not be obtained, the team leveraged these partnerships to learn more about alternate data sources for their analysis. Currently, the team is using NLSY97 data to examine factors that lead people into technology careers and factors that relate to individuals staying in those careers. These analyses will continue into the final year of the project (Year 4).

In addition to the planned Year 3 tasks, the PathTech team completed several other activities in response to the research that was already underway. Based on the initial themes emerging from analysis of community college interviews, the team added a case study of female ET students to explore the unique opportunities and challenges faced by this population. They created an updated protocol for these interviews and completed six case study interviews during Year 3. The team also updated the PathTech website to reflect current research efforts, links to presentations and reports, and resources from partnering colleges and high schools. On top of their dissemination efforts in Year 3, the team submitted an extended abstract to Russell Sage for inclusion in an edited volume on higher education and finalized their submission to *Education Evaluation and Policy Analysis*.

3. Conclusions

In Year 3 of the PathTech project, the team has built upon the successes they achieved in Year 1 and 2, concluding fieldwork and beginning both qualitative and quantitative analysis. After challenges obtaining FLDOE data, the team is now conducting analysis using NLSY97 data, with ongoing analysis continuing into the final year of the grant. During Year 3, the PathTech team continued to be responsive to initial findings, which led to an exploration of the unique pathways of women in the ET field through a targeted case study. The team continued to pursue networking and partnership opportunities with key stakeholders who are both important to completing the project as well as to those in the field who have an interest in the outcomes of the study through local, regional and national forums and conferences. This has generated excitement about PathTech in Florida and beyond. Through their outreach to various stakeholder groups, the PathTech team has been able to identify the pulse of these groups to understand how to carry out their research based on a devised plan while also being responsive to emerging themes and trends. As the final year of the grant begins, the PathTech team will continue analysis and dissemination tasks, supported by the strong foundation they established in Years 1-3.

4. Next Steps in the External Evaluation

Evaluation activities over the final year of the NSF grant period include: (1) ongoing monitoring of the progress of the project against project timelines; (2) objective review of data analysis plans and quality of the multivariate analyses; (3) evaluation of the interpretability of course trajectories between the cohorts; (4) review of the replicability of the analyses conducted; and (5) provision of recommendations for sustainability efforts, ongoing research opportunities, and future directions of the project.

In addition, the evaluation team will continue to serve as external resources for technical advice, and will provide commentaries and written reviews of the project's various activities, including conference presentations and journal submissions, as appropriate. The evaluation team will maintain regular, monthly contact with Dr. Tyson and the rest of the project team via monthly

teleconferences and ad hoc email communication, while bringing in other members of the external evaluation team as needed. The evaluation team will continue to prepare monthly monitoring tracking spreadsheets, in which evaluators assess the research team's progress towards project milestones and make suggestions for addressing challenges are provided.

A final evaluation report will build off previous reports and summarize evaluation activities and findings during the final year of the grant as well as across the grant period. This will be submitted to NSF as part of the annual reporting requirements, as evidence of the quality of the project's quality assurance procedures.